

WHAT IS CLAIMED IS:

1. A computer-implemented process for providing an interactive user interface to a database of information describing contents of an input signal,
5 comprising:
 - extracting at least one fingerprint from each of at least one sample of at least one input signal;
 - comparing the extracted fingerprints to known fingerprints in a database of fingerprints of known signal objects to locate matching fingerprints for identifying
10 one or more objects embedded in the at least one input signal as a known signal object;
 - storing one or more extracted fingerprints that do not match any fingerprints in the database of fingerprints to the database of fingerprints as an unknown object fingerprint for use in matching subsequent instances of repeating
15 objects in the at least one input signal;
 - in an object database, storing statistical information derived from the at least one input signal for each sample having an extracted fingerprint that matches a known fingerprint; and
 - providing an interactive user interface for querying the statistical
20 information in the object database.
2. The computer-implemented process of claim 1 wherein the database of fingerprints includes metadata corresponding to information describing attributes of fingerprints in the database of fingerprints.
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3. The computer-implemented process of claim 2 further comprising:
 - extracting any metadata and statistical information associated with any extracted fingerprints that match an entry in the database of fingerprints; and
 - storing the extracted metadata to the object database for each sample
30 having an extracted fingerprint that matches a fingerprint of a known signal object.

4. The computer-implemented process of claim 1 wherein the at least one input signal comprises one or more FM radio station broadcast signals in one or more geographic regions.

5 5. The computer-implemented process of claim 1 wherein the at least one input signal comprises one or more television broadcast signals in one or more geographic regions.

10 6. The computer-implemented process of claim 1 wherein the at least one input signal comprises one or more cable video signals in one or more geographic regions.

15 7. The computer-implemented process of claim 1 wherein the at least one input signal comprises one or more FM radio station broadcast signals in one or more geographic regions.

8. The computer-implemented process of claim 1 wherein the at least one input signal comprises one or more Internet multimedia streams.

20 9. The computer-implemented process of claim 4 further comprising multiplexing two or more FM radio station broadcast signals into a single input signal prior to extracting the at least one fingerprint from that single input signal.

25 10. The computer-implemented process of claim 1 wherein the at least one input signal comprises at least one user selectable FM radio station broadcast signals in one or more geographic regions.

11. The computer-implemented process of claim 1 further comprising buffering the at least one input signal for a predetermined period of time.

12. The computer-implemented process of claim 1 further comprising
storing the at least one input signal on a computer readable medium.

5 13. The computer-implemented process of claim 1 further comprising,
obtaining at least one signal sample via the user interface;
extracting a sample fingerprint from each signal sample;
adding each sample fingerprint to the database of fingerprints; and
identifying one or more objects embedded in the at least one input signal
by comparing the extracted fingerprints to sample fingerprints added to the
10 database of fingerprints.

14. The computer-implemented process of claim 1 wherein the
interactive user interface is a web-browser based user interface for performing
user queries of the object database across the Internet.

15 15. The computer-implemented process of claim 1 further comprising
identifying one or more objects embedded in the at least one input signal as an
unknown object by comparing the extracted fingerprints to unknown object
fingerprints in the database of fingerprints of known and unknown signal objects
20 to locate matching fingerprints.

16. The computer-implemented process of claim 1 wherein the
interactive user interface for querying the statistical information in the object
database comprises at least one predefined user selectable database query.

25 17. The computer-implemented process of claim 1 wherein the object
database is implemented on at least one local server computer and the
interactive user interface is provided on at least one remote client computer
accessible via the Internet for providing remote client interaction with the local
30 object database.

18. The computer-implemented process of claim 1 further comprising automatically generating at least one set of information for characterizing at least one of the input signals, and automatically transmitting that set of information from a server computer to at least one client computer.

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19. The computer-implemented process of claim 1 wherein sampling of a particular input signal is suspended for a period of time when an object embedded in that input signal is identified in that signal, and where the period of time is either predetermined or is determined by the characteristics of the 10 identified object.

20. The computer-implemented process of claim 1 wherein extracting at least one fingerprint from each of at least one sample comprises performing a distortion discriminant analysis of each sample to generate fingerprints.

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21. The computer-implemented process of claim 1 further comprising a user interface for inputting at least one user specified signal sample, and wherein fingerprints are automatically extracted from each user specified signal sample and added to the known fingerprints in the database of fingerprints.

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22. The system of claim 17 further comprising a user interface for entering metadata associated each user specified signal sample.

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23. A system for determining content of multiple media streams in real time, comprising:

simultaneously monitoring two or more media streams in real time;
sampling each media stream;
deriving a signal fingerprint from each sample from each media stream;
comparing each signal fingerprint to a fingerprint database, said fingerprint 30 database including known fingerprints of known media objects and metadata information describing the known media objects;

identifying one or more media objects by locating matching fingerprints of known media objects to each signal fingerprint;

populating an object database residing on at least one local server computer with statistical information derived from each identified media object,

5 and with any metadata associated with the matching fingerprint of any known media objects; and

providing an interactive user interface for allowing at least one remote client computer to interact across a network with the object database residing on the at least one local server computer.

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24. The system of claim 23 wherein the network is the Internet.

25. The system of claim 23 wherein the media objects are any of songs, music, advertisements, commercials, station identifiers, speech audio clips, and emergency broadcast signals.

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26. The system of claim 23 wherein the two or more media streams comprise television broadcast signals.

20 27. The system of claim 23 wherein the two or more media streams comprise cable multimedia broadcast signals.

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28. The system of claim 23 wherein the two or more media streams comprise Internet multimedia streams.

29. The system of claim 23 wherein the two or more media streams comprise automatically selected FM radio station broadcast signals in one or more geographic regions.

30. The system of claim 23 wherein the two or more media streams comprise user selectable FM radio station broadcast signals in one or more geographic regions.

5 31. The system of claim 23 further comprising simultaneously applying separate fingerprint extraction engines to each media stream for deriving the signal fingerprint for each sample from each media stream.

10 32. The system of claim 29 further comprising monitoring at least one automatically tunable receiver, wherein each automatically tunable receiver automatically switches between at least two radio broadcast streams at predefined intervals and samples each of the at least two radio broadcast streams for a predefined period of time.

15 33. The system of claim 31 further comprising multiplexing the samples from each automatically tunable receiver into a separate multiplexed radio broadcast stream.

20 34. The system of claim 33 wherein deriving the signal fingerprint for each sample from each radio stream comprises simultaneously operating a separate fingerprint extraction engine for each multiplexed radio broadcast stream for deriving the signal fingerprint for each sample comprising each multiplexed radio broadcast stream.

25 35. The system of claim 29 further comprising monitoring at least one automatically tunable receiver, wherein each automatically tunable receiver automatically switches between at least two radio broadcast streams at intervals that are defined by what has been identified.

36. The system of claim 35 further comprising multiplexing the samples from each automatically tunable receiver into a separate multiplexed radio broadcast stream.

5 37. The system claim 23 wherein the interactive user interface comprises at least one predefined user selectable query for querying any statistical information and metadata in the object database.

10 38. The system of claim 37 wherein the at least one predefined user selectable query includes a query for displaying user selectable music artist statistical information with respect to one or more user selectable media streams.

15 39. The system of claim 37 wherein the at least one predefined user selectable query includes a query for displaying statistical content information with respect to at least one user selectable media streams.

40. The system of claim 37 wherein the at least one predefined user selectable query includes a query for displaying statistical music artist information with respect to at least one user selectable media streams.

20 41. The system of claim 37 wherein the at least one predefined user selectable query includes a query for displaying statistical commercial information with respect to at least one user selectable media streams.

25 42. The system of claim 23 further comprising storing each monitored media stream for a predetermined period of time

30 43. The system claim 23 wherein the interactive user interface further comprises a user selectable control for automatically providing a playback of at least one user selectable media object identified in one or more of the media streams.

44. The system claim 23 wherein the interactive user interface further comprises a control for adding a user selectable media sample corresponding to a user identified media object, and wherein a signal fingerprint is automatically derived from the user selectable media sample and added to the fingerprint database along with user entered metadata for describing the user selectable media sample.

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45. The system of claim 23 wherein further comprising automatically adding any fingerprints derived from each sample to the fingerprint database where the derived fingerprints do not match any signal fingerprints in the fingerprint database.

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46. The system of claim 23 further comprising automatically compiling a predetermined set of information from the object database, and automatically pushing that information from at least one of the local server computers to at least one of the remote client computers.

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47. The system of claim 23 wherein deriving a signal fingerprint from each sample from each media stream comprises applying a distortion discriminant analysis to each sample for deriving a trace representing a signal fingerprint from each sample.

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48. The system of claim 23 further comprising a user interface for inputting at least one user media sample and associated metadata for describing each user audio sample.

49. The system of claim 48 further comprising automatically deriving a signal fingerprint from each user media sample, and storing that fingerprint and any associated metadata in the fingerprint database.

50. A method for providing an interactive user interface for querying a database of content information that characterizes at least one signal, comprising:

- monitoring at least one user selectable media broadcast signal common to
- 5 a user selectable geographic region using at least one automatically tunable receiver;
- sampling each broadcast signal for any of predefined periods of time and for periods of time determined by media objects identified in the at least one broadcast signal;
- 10 deriving a media object trace fingerprint from each sample, using a separate instance of a fingerprint engine for each receiver for simultaneously processing each monitored broadcast signal in real-time;
- comparing each media object trace fingerprint to a fingerprint database, said fingerprint database including known fingerprints of known media objects,
- 15 metadata information describing the known media objects, and fingerprints of unknown objects for identifying unknown but repeated objects;
- identifying one or more media objects in one or more of the broadcast signals by comparing each media object trace fingerprint to the known fingerprints in the fingerprint database to locate matching fingerprints of known
- 20 media objects;
- populating an object database residing on at least one local server computer with statistical information derived from each identified media object, and with any metadata associated with the matching fingerprint of any known media objects; and
- 25 providing an interactive user interface for allowing at least one remote client computer to interact across a network with the object database residing on the at least one local server computer.

51. The method of claim 50 wherein the unknown but repeated objects are themselves stored in an unknown object database, and further comprising analyzing the unknown but repeated objects to determine metadata describing

the unknown but repeating objects, said metadata then being entered in the fingerprint database.

52. The method of claim 51 wherein analyzing the unknown but
5 repeated objects to determine metadata comprises manual user identification
and entry of the metadata for one or more of the repeated objects via the
interactive user interface.

53. The method of claim 51 wherein analyzing the unknown but
10 repeated objects to determine metadata comprises automatically identifying the
unknown but repeated objects by comparing the objects to at least one additional
object database, and importing any metadata associated with the automatically
identified unknown but repeated objects into the fingerprint database.

15 54. The method of claim 50 wherein the at least one user selectable
broadcast signal is a radio station

55. The method of claim 50 wherein the at least one user selectable
broadcast signal is any of a television broadcast signal, an internet broadcast
20 signal, a network broadcast signal, and a cable broadcast signal.

56. The method of claim 50 wherein the network is the Internet.

57. The method of claim 50 wherein the object database is an SQL
25 database.

58. The method of claim 50 wherein the interactive user interface
comprises at least one predefined user selectable query for retrieving statistical
information and metadata from the object database by user selection of the
30 predefined user selectable query.

59. The method of claim 50 wherein media objects include any of music, advertisements, commercials, station identifiers, speech audio clips, videos, and emergency broadcast signals.

5 60. The method of claim 50 wherein metadata includes any of radio station call signs, music titles, song titles, music artist names, music album titles, commercial titles, commercial product information, and video titles.

10 61. The method of claim 50 wherein statistical information includes any of media object play times, media object play dates, media object play station, and media object number of plays.

15 62. The method of claim 55 wherein the user selectable query includes SQL queries for extracting information relating to the media objects, metadata, and statistical information in the object database.

63. The method of claim 50 wherein the interactive user interface is a web-browser based user interface.

20 64. The method of claim 50 further comprising automatically generating at least one report comprising statistical and metadata for describing one or more of the media broadcast signals.

25 65. The method of claim 64 further comprising automatically transmitting the at least one report to at least one of the remote client computers.

30 66. The method of claim 50 wherein deriving the media object trace fingerprint from each sample comprises applying a distortion discriminant analysis to each sample for deriving a trace representing the media object trace fingerprint from each sample.